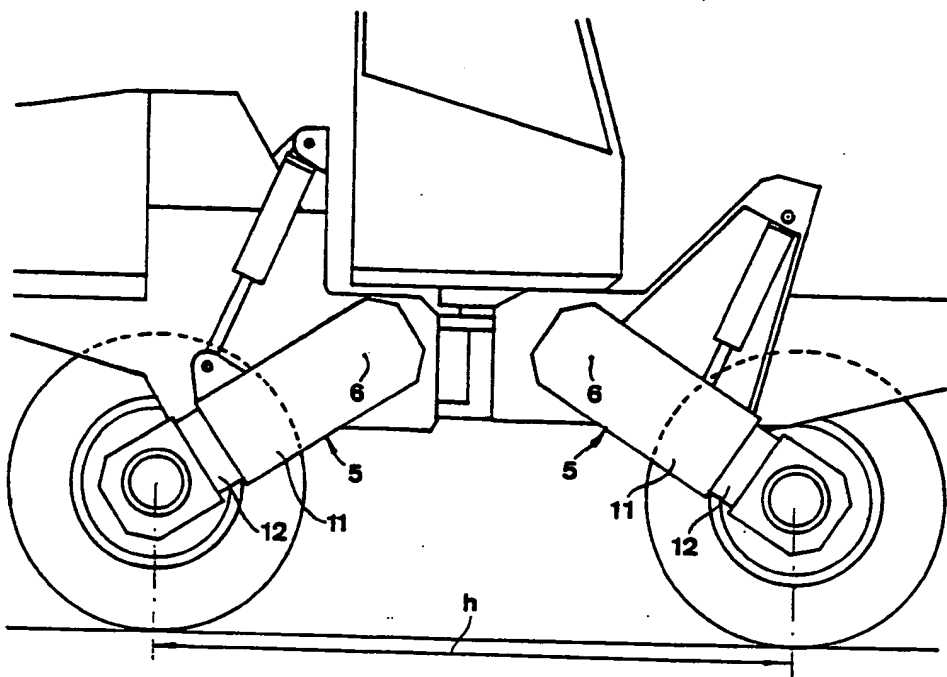




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/SE91/00831 <b>(22) International filing date:</b> 5 December 1991 (05.12.91)  <b>(30) Priority data:</b> 9003900-9 7 December 1990 (07.12.90) SE  <b>(71)(72) Applicant and Inventor:</b> ERIKSSON, Peter [SE/SE]; Box 4, S-810 20 Österfärnebo (SE).  <b>(74) Agent:</b> BJERKÉN, Jarl, Håkan; Bjerkéns/Gävle Patentbyrå AB, Box 304, S-801 04 Gävle (SE).  <b>(81) Designated States:</b> AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), MC (European patent), NL (European patent), NO, SE (European patent), US.		<b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>
<b>(54) Title:</b> A DEVICE IN VEHICLES    <b>(57) Abstract</b>  A device in vehicles comprises a chassis (1) and pivot arms (5) carrying wheels and being pivotable in substantially vertical planes relative to the chassis. The pivot arms are arranged variable in length for changing the distance between the pivot axes (6) of the pivot arms and the wheels (2).		

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<sup>+</sup> Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

A device in vehicles

## FIELD OF THE INVENTION AND PRIOR ART

This invention is related to a device in vehicles comprising a chassis and pivot arms carrying wheels and being pivotable relative to the chassis in substantially vertical planes. The vehicle is preferably a transport vehicle, in particular for more considerable loads. A preferred application for the vehicle is within the forestry, where the vehicle could be intended for transportation of forest products, for instance logs and timber and/or forestry machines, for instance machines for felling, delimbing, cutting, barking and/or chipping of trees.

Vehicles of the nature defined in the introduction have the decisive advantage that the pivot arms make it possible to achieve excellent driving and working properties, in particular in difficult terrain, such as in the forest. The pivot arms enable, on one hand, even running since they may pivot in substantially vertical planes in adjustment to the terrain conditions. On the other hand, the pivot arms may be adjusted individually so that the vehicle may obtain a desired, for instance horizontal, position also when the ground is sloping. Depending upon how the vehicle stands relative to the direction of slope, the, particularly, horizontal position may be obtained by pivoting the pivot arms located farthest down in the slope downwardly, whereas the pivot arms located farthest up in the direction of slope are pivoted upwardly.

Thus, it is suitable that the pivot arms have a considerable range of pivoting so that a considerable change of the position of the wheels vertically relative to the chassis may be carried out. In this way the vehicle may, upon pivoting downwardly of the pivot arms, obtain a considerable belly clearance, which is preferable for driving over relatively high obstacles. In connection with vehicles with for instance four wheels it is from many points of view suitable to arrange the pivot arms on the chassis so that they point substantially forwardly and rearwardly respectively, that is in directions away from each other, starting from their pivot axes. On pivoting downwardly of the pivot arms in order to raise the vehicle chassis on one side or both sides, the wheels will then describe arcs while the wheels located on one side of the vehicle approach each other. This means that the wheel base measure on this side will be reduced, which in turn causes a deteriorated stability to tendencies to tipping forwardly/rearwardly.

#### SUMMARY OF THE INVENTION

The object of the present invention is to develop the device defined in the introduction so as to achieve an increased flexibility as to the operability of the pivot arms.

This object is obtained according to the invention primarily by one or more of the pivot arms being arranged variable in length to change the distance between the pivot axis of the pivot arm and the wheel axis.

The solution according to the invention makes it possible to lengthen and shorten respectively the effective length of the pivot arms in operational cases where this is required. In the case described hereinabove in connection with the presentation of prior art and involving a wheel base reduction on pivoting downwardly of the pivot arms, said wheel base reduction may be counteracted, eliminated or even reversed into a wheel base increase by extending the pivot

arms to necessary degree before, during or after pivoting downwardly of the pivot arms, whereby a stability improvement in the direction forwardly/rearwardly of the vehicle may be obtained. The possibility to change the length of the pivot arms may, however, be of great importance also in other connections, for instance for pivot arms located at one end of a vehicle. It could then be desirable in certain operational situations to extend the wheels more or less past the adjacent end of the chassis by lengthening the pivot arms. On the other hand, other conditions, such as a limited driving space, may make it desirable that the wheels at said chassis end do not extend past the same; the wheels may then be retracted by shortening the pivot arms.

Preferable developments of the concept of the invention are defined in the dependent claims. The embodiment involving a change of the tread gauge of the vehicle should be noted specifically.

#### BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the enclosed drawings a more specific description of embodiment examples of the invention follows hereinafter.

In the drawings:

Fig 1 is a diagrammatical side view of a vehicle;

Fig 2 is a partial and partly cut view of the vehicle according to Fig 1 in a certain operational position;

Fig 3 is a view similar to Fig 2 but illustrating the vehicle in another operational position;

Fig 4 is a view illustrating a chassis portion, a pivot arm and a wheel in a view from above, the pivot arm being partially cut;

Fig 5 is a perspective view illustrating a pivot arm and a power member for pivoting thereof;

Fig 6 is a view similar to Fig 4 of an alternative embodiment;

Fig 7 is a view similar to Fig 6 but illustrating another operational position; and

Fig 8 is a view illustrating the pivot arm and the power member for operation thereof corresponding to the position according to Fig 7.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The land vehicle illustrated in Fig 1 comprises a chassis 1 and, in the embodiment, four wheels 2 arranged thereat. The chassis 1 may for instance be of the type comprising forward and rear chassis portions pivotably interconnected for steering purposes about a substantially vertical axis 3.

It is to be emphasized that when the term "wheel" is used in the following, this term is intended to comprise so called bogie arrangements having two or more wheels and such arrangements where one or more wheels act supportingly and guidingly for a drive track. An individual wheel of the vehicle could accordingly be replaced by a bogie or a track drive device.

The vehicle is here intended to operate as a carrier for a working machine 4, which may be arranged on the vehicle by means of a crane as illustrated or any other suitable carrying arrangement. The machine 4 is in this case formed by a forestry machine, for instance a tree processor, whereas the vehicle is a terrain vehicle suitable for propulsion in a forest.

Each of the wheels 2 of the vehicle is arranged on a pivot arm 5, the pivot axis of which is denoted 6 and which is pivotably arranged at the chassis 1 in substantially vertical planes. To pivot the pivot arms 5 power members 7, for instance hydraulic cylinders, are arranged and these are suitably variable in length and acting between the vehicle chassis 1 and the pivot arm in question. It appears from Figs 1-3 and 5 that the power member 7 acts between an attachment 8 on the chassis and an attachment 9 on pivot arm 5.

The vehicle obtains exquisite terrain driving properties by means of the pivot arms 5 and furthermore, the driver may by adequate adjustment of the pivoting positions of the different pivot arms adjust the position of the vehicle to for instance a horizontal one also when the terrain is sloping steeply.

The pivot arms for the four wheels are in the embodiment arranged so that they project forwardly and rearwardly, that is away from each other, starting from their pivot axes 6. It is pointed out in this connection that it is intended that the pivot arms 5 should be pivotable considerably in vertical direction, the pivot arms normally being pivotable downwardly as well as upwardly from a substantially horizontal intermediate position.

The wheel base of the vehicle is illustrated with the designation h in Fig 2 for the adjusted position of the pivot arms 5. If the driver would pivot the pivot arms further downwardly to raise the vehicle chassis, the wheel base measure h in the longitudinal direction of the vehicle is decreased, which means a reduction of stability, that is a reduction of the stability to tipping forwardly/rearwardly. In order to be able to counteract, for instance, such stability reduction, the pivot arms 5 are arranged variable in length to change the distance between the pivot axes 6 of the pivot arms and the wheels 2. Thus, this means that the

distance between the pivot axis 6 of a pivot arm and the axis 10 of rotation of the wheel may be increased and decreased respectively as far as the individual pivot arm is concerned.

If increase of the length of the pivot arm 5 is effected when the arm is pivoted downwardly to raise the vehicle, the previously described wheel base decrease is compensated. The pivot arms 5 are illustrated with their minimum length in Fig 2. In Fig 3 it is illustrated that the pivot arms 5 have been swung downwardly about the axes 10 from their positions shown in Fig 2. If the pivot arms had invariable length this would in the case described cause a decrease of the wheel base measure h. However, it is illustrated in Fig 3 that the pivot arms 5 have been somewhat lengthened relative to the state illustrated in Fig 2. For exemplifying purpose the same wheel base measure h has been chosen in Fig 3 as in Fig 2, which means that pivoting downwardly of the pivot arms 5 may be balanced with lengthening thereof so that the wheel base measure h does not decrease. Moreover, the pivot arms 5 could of course be lengthened more than in Fig 3 so that in reality a wheel base increase would occur relative to the position in Fig 2.

Conditions for length variation of the pivot arms 5 are created if each pivot arm comprises at least two parts 11, 12 adjustably moveable relative to each other. It is preferred (see also Figs 4 and 5) that these parts 11, 12 are based upon displaceability of a telescopical nature, that is the parts 11, 12 may be telescopically coordinated immediately to each other or by means of one or more intermediate telescopic elements. In the embodiment it is conceived that part 12 is displaceably received in an internal space in part 11.

As appears from Fig 4 a power member 13 acts between the parts 11, 12. This power member is preferably arranged withing a space formed by the parts 11, 12 and is,



accordingly, with a first end connected to part 11 and with a second end to part 12.

The part 11 has the character of a base part of the pivot arm 5 in the sense that it is the part 11 which is pivotably journaled to the chassis 1 about axis 6, whereas accordingly part 12 extends radially outwardly from part 11.

The part 12 comprises at its extreme end a support member 14 arranged for the wheel 2, said support member being, accordingly, located at the extreme end of the pivot arm and comprising some suitable kind of means 15 for applying the wheel 2 to the support member. It is pointed out in this connection that a drive motor, suitably a hydraulic one, for rotating the wheel 2 may be incorporated into or arranged on the support member 14 or otherwise built into a hub for the wheel.

The attachment 9 for the power member 7 for pivoting the pivot arm is here provided on the part 11.

The vehicle comprises, in the embodiment illustrated in Figs 6-8, for each of the wheels 2 means 16 for lateral displacement of the wheel 2 relative to the chassis 1 to change the tread gauge of the vehicle. In the views according to Figs 6 and 7 the wheel appearing to the left in Fig 1 and its suspension is supposed to be illustrated substantially from above. On a comparison between Figs 6 and 7 it appears immediately that the displacement means 16 allow the wheel 2 to be displaced laterally relative to the chassis 1 to a considerable degree. It is understood that a substantially improved lateral stability of the vehicle may be obtained if all the wheels thereof are located laterally displaced outwardly from the vehicle in correspondence to that which appears from Fig 7. When, on the other hand, the wheels are displaced inwardly towards the longitudinal center line of the vehicle according to Fig 6, the lateral stability is reduced but instead an increased operational flexibility of

the vehicle is obtained due to its decreased total width (it is of course presupposed that it is the wheels which are decisive for the width).

The more specific design will, in the following, be described in connection with a single wheel and its suspension. As already has appeared hereinabove, it is often preferred that all wheels of the vehicle are made laterally displaceable but this is no necessity. Thus, the advantages aimed at with the invention are also obtained in vehicles where not all but, however, at least one vehicle wheel is made laterally displaceable. It is, namely, conceivable that a working machine requiring extra stability may be intended to be carried in such a way relative to the vehicle that it is sufficient from the point of view of stability to make a single wheel of the vehicle laterally displaceable.

Between the wheel 2 and chassis 1 there is provided a swinging arm arrangement forming said displacement means 16. The swinging arm arrangement is swingable in planes substantially parallel to an axis 10 of rotation of the wheel 2.

The swinging arm arrangement 16 comprises, with preference, at least two swinging arms 17, 18, which are swingably connected between the vehicle chassis 1 and wheel 2. The swinging arm arrangement 16 forms suitably an articulated quadrangle, the articulation axles of which closest to the chassis 1 are denoted 19, 20 and the articulation axles of which closest to the wheel 2 are denoted 21, 22.

It is preferred that the arrangement 16 forms a parallelogram control, that is the wheel will always be located in planes of rotation substantially parallel to the displacement direction of the vehicle independently of the angular position of the swinging arm arrangement 16.

In the embodiment according to Figs 6-8 the swinging arm arrangement 16 forms a part of the pivot arm 5 such that the

swinging arm arrangement is adapted to accompany the pivot arm on pivoting thereof about the axis 6.

Also in this embodiment (Fig 8) a power member 7 for pivoting the pivot arm 5 acts between an attachment 8 on the chassis 1 and an attachment 9 on the pivot arm. It is, however, here preferred that the attachment 9 is arranged on a support member 14 located at the extreme end of the pivot arm. The support member 14 comprises, also here, some suitable kind of means 15 for providing the wheel 2 on the support member. It is pointed out in this connection that a drive motor, suitably a hydraulic one, for rotating the wheel 2 may be incorporated into or arranged on the support member 14 or otherwise built into a hub for the wheel.

From that stated it appears that the swinging arm arrangement 16 has the character of a connection incorporated into pivot arm 5 between a base member 11 of the pivot arm, said base member being the one which is pivotably associated to chassis 1 about the axis 6, and the wheel support member 14. On swinging of the swinging arm arrangement 16 to obtain a tread gauge change, the power member 7 will also swing somewhat laterally which means that the power member 7 should be connected to the chassis 1 and support member 14 via not only imaginary or real hinge axles 23 but also further hinge arrangements 24 allowing the lateral swinging, for instance universal hinges of the ball type.

A power member 25 is suitably arranged for swinging the swinging arm arrangement 16 and, accordingly, for the lateral displacement of the wheel. This power member could be formed by a power member variable in length acting between diagonally arranged articulation axles, for instance those denoted 19 and 22, in the swinging arm arrangement 16. The power member will then obtain a protected position within the swinging arm arrangement and this protected position will be even more accentuated if the swinging arms 17, 18 are designed as appears in Fig 8 for the swinging arm

18, namely with a laterally directed, substantially planar portion 26 forming a screen between the power member 25 and the surrounding. As seen from Fig 8 the swinging arms comprise portions 27, which extend laterally relative to the wall portion 26 and which interact journalingly with the articulation axles 19-22. With other words, it is, accordingly, preferred that each of the swinging arms 17, 18 has an U-shaped cross-section, the shanks of the U-shaped swinging arms being directed towards each other.

The length of the pivot arm 5 is variable in the basic manner already described also in the embodiment according to Figs 6-8. More specifically, the pivot arm comprises also here two parts 11, 12 which are mutually displaceable and of which the part 11 has the character of a base part pivotably journalled to chassis 1 about the axis 6. The part 12 is associated to the support member 14 for the wheel 2, more specifically via the swinging arm arrangement 16. The part 12 may comprise or be connected to a connection portion 28, which forms one side of the articulated quadrangle of the swinging arm arrangement 16 and with which the articulation axles 19, 20 of the quadrangle engage. The parts 11, 12 are as previously telescopically coordinated and delimit in unison the space, in which a power member 13 for length variation of the pivot arm is received.

As appears on a comparison between Fig 6 on one hand and Figs 7 and 8 on the other hand the length of the pivot arm may be varied and, moreover, the wheel may be displaced laterally.

The invention is of course not only restricted to the embodiments described but the device may instead be modified in several ways within the scope of the invention.

Claims

1. A device in vehicles comprising a chassis (1) and pivot arms (5), which carry wheels and which are pivotable relative to the chassis in substantially vertical planes, characterized in that one or more of the pivot arms (5) are arranged variable in length to change the distance between the pivot axes (6) of the pivot arms and the wheels (2).

2. A device according to claim 1, characterized in that the pivot arm (5) comprises at least two parts (11, 12) adjustably moveable relative to each other.

3. A device according to claim 1, characterized in that the pivot arm (5) comprises at least two parts (11, 12) telescopically displaceably coordinated with each other.

4. A device according to claim 2 or 3, characterized in that a power member (13) acts between the parts.

5. A device according to claim 4, characterized in that the power member (13) is arranged in a cavity formed by the parts (11, 12).

6. A device according to any preceding claim, characterized in that it for at least one of said wheels (2) comprises means (16) for lateral displacement of the wheel relative to the chassis (1) to change the tread gauge of the vehicle.

7. A device according to claim 6, characterized in that a swinging arm arrangement (16), which forms said displacement means, is arranged between the wheel (2) and the chassis.

8. A device according to claim 7, characterized in that the swinging arm arrangement (16) is swingable in planes substantially parallel to an axis (10) of rotation of the wheel.

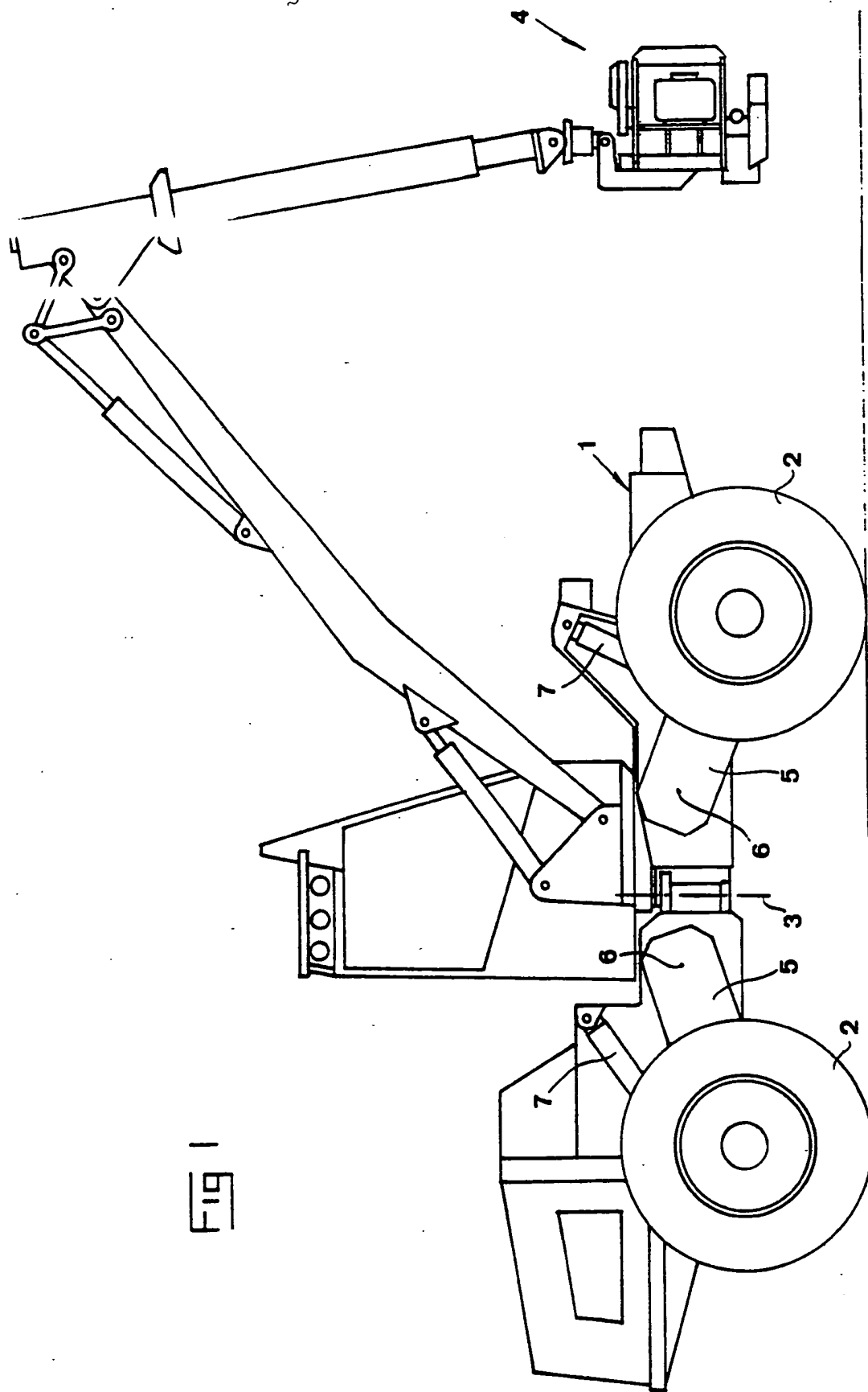
9. A device according to any of claims 7 - 8, characterized in that the swinging arm arrangement (16) comprises at least two swinging arms (17, 18), which are swingably connected between the chassis (1) and the wheel (2).

10. A device according to any of claims 7 - 9, characterized in that the swinging arm arrangement (16) forms an articulated quadrangle.

11. A device according to any of claims 7 - 10, characterized in that the swinging arm arrangement (16) forms an articulated parallelogram (19-22).

12. A device according to any of claims 7 - 11, characterized in that the swinging arm arrangement (16) forms a part of the pivot arm (5) such that the swinging arm arrangement is adapted to accompany the pivot arm on pivoting thereof.

13. A device according to any of claims 9 - 12, characterized in that a power member (25), which is variable in length, acts between diagonally arranged articulation axles (19, 22) in the swinging arm arrangement (16).



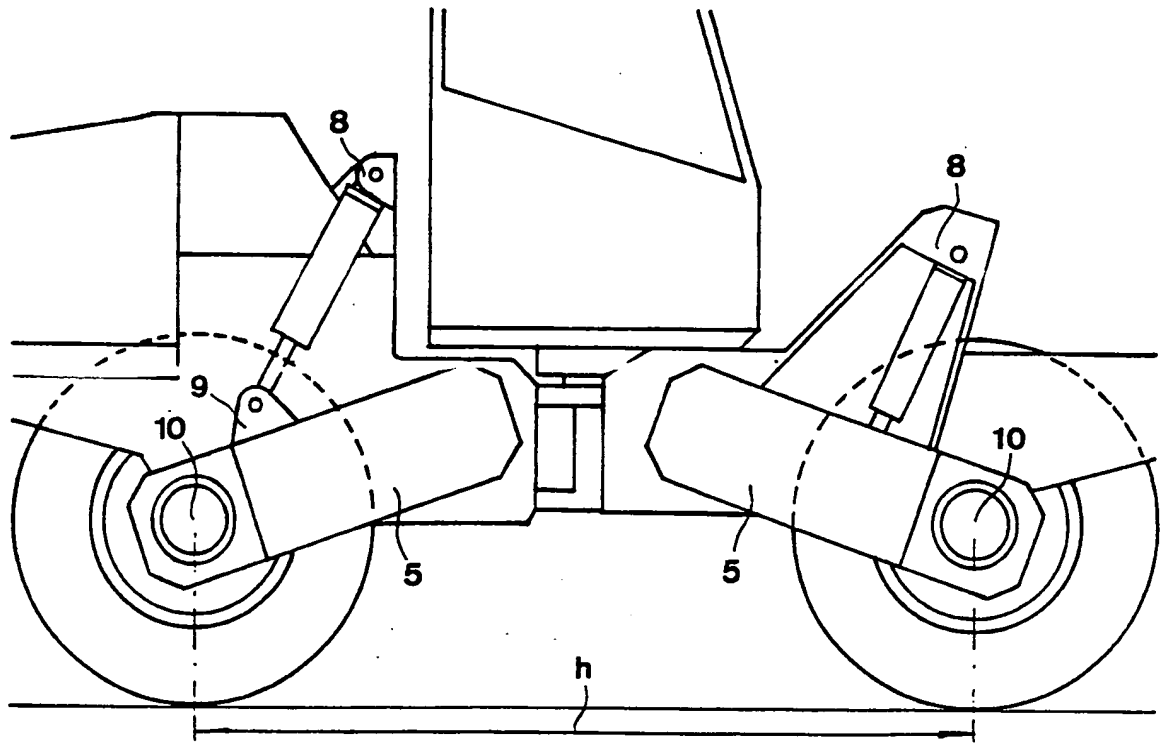


Fig 2

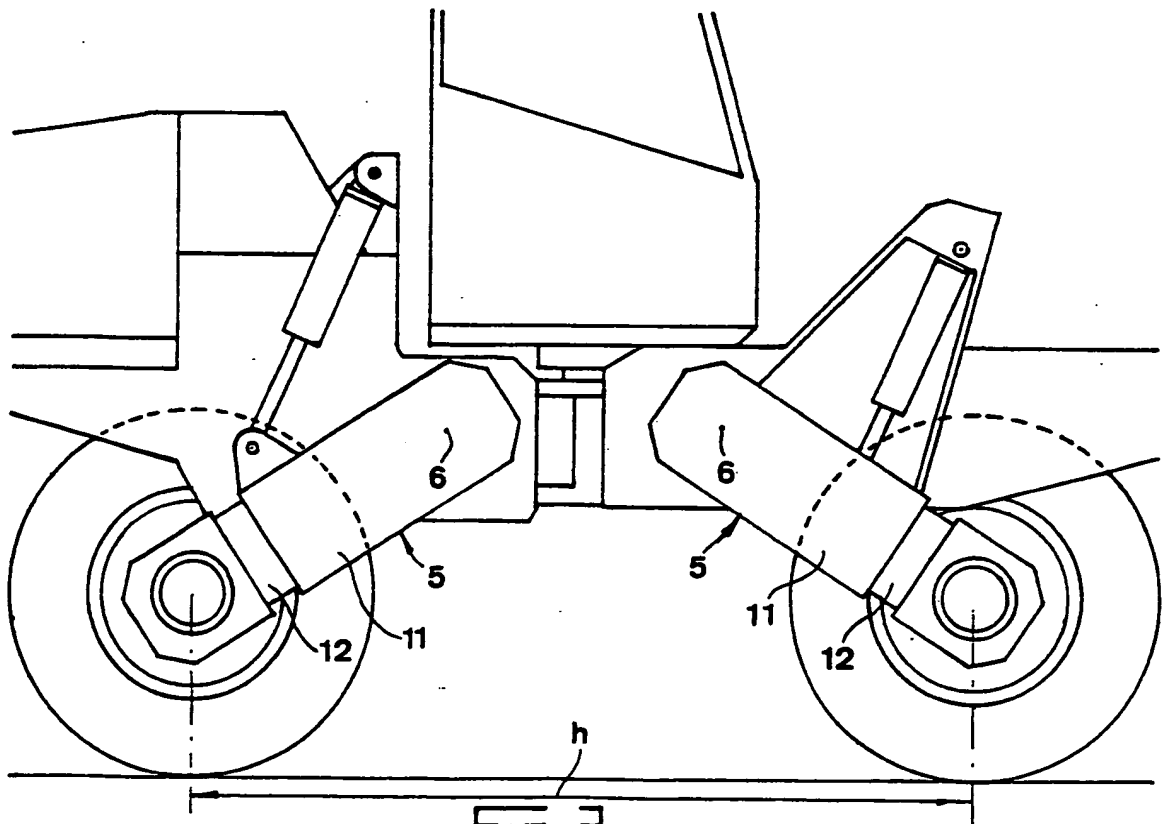


Fig 3



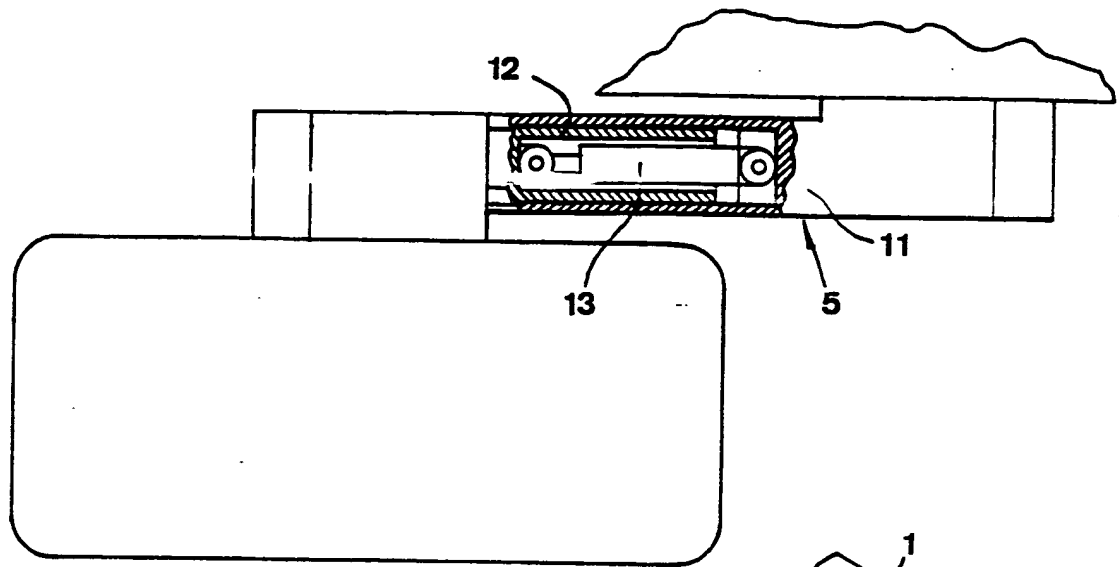


Fig 4

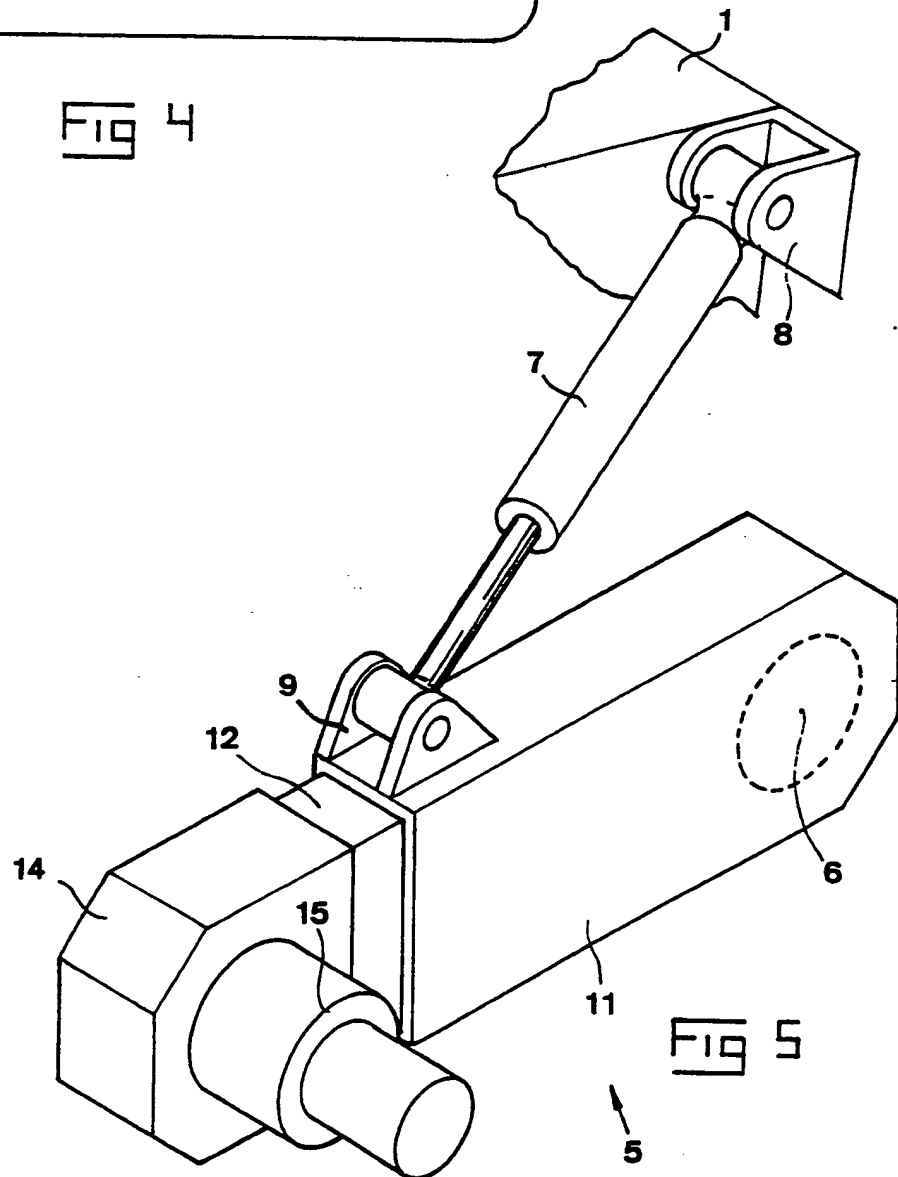


Fig 5

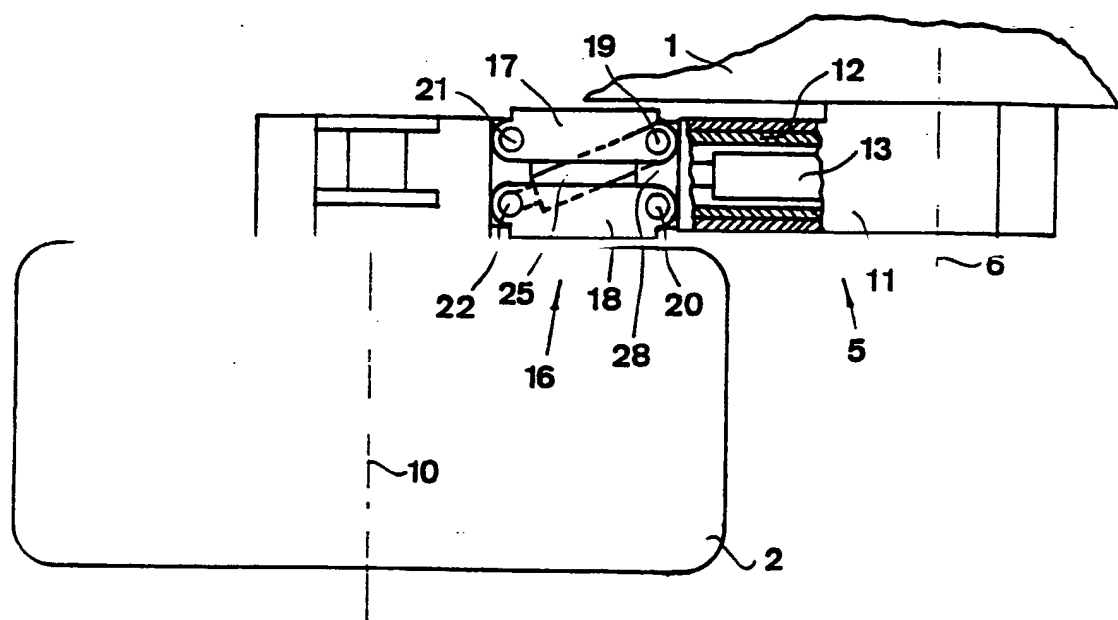


Fig 6

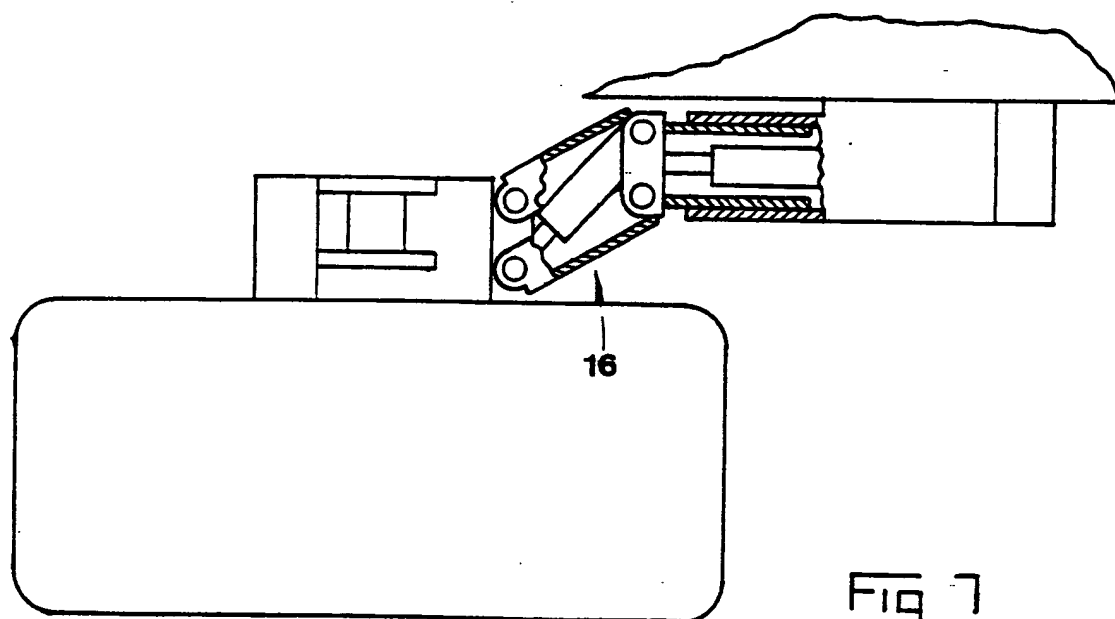


Fig 7

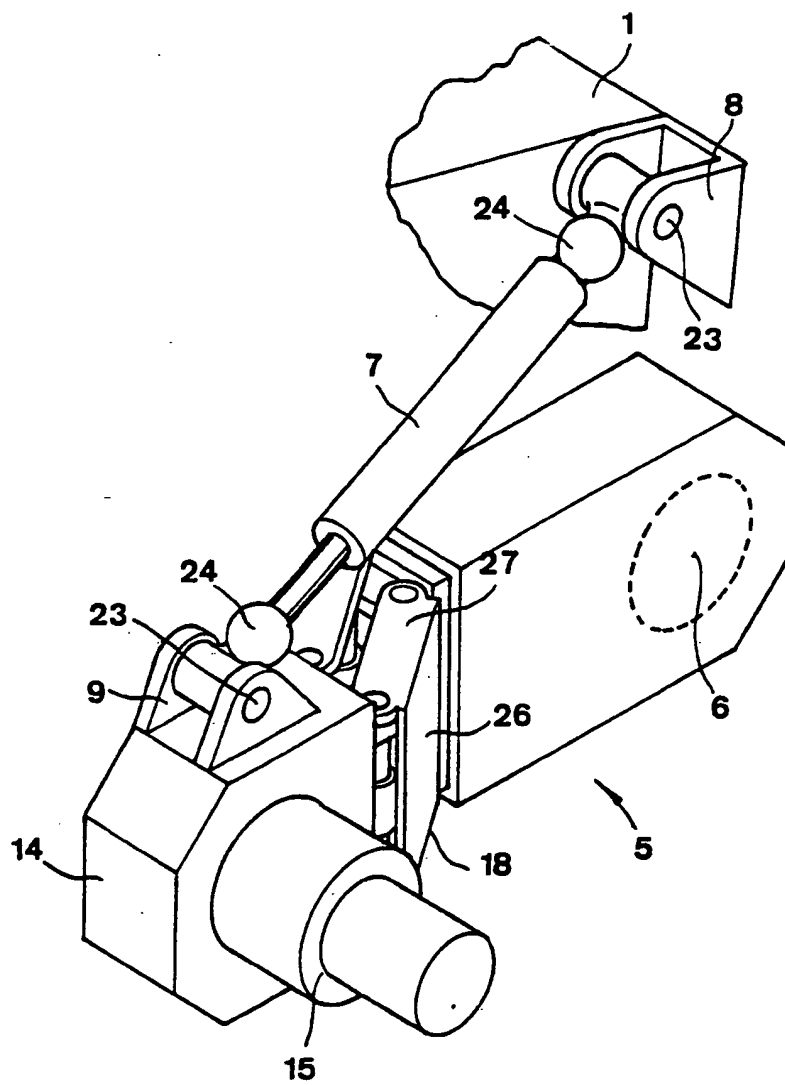


Fig 8

# INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00831

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: B 62 D 61/00</b>																							
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched<sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px; vertical-align: top;">IPC5</td> <td style="padding: 5px; vertical-align: top;">B 62 D</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched<sup>8</sup></div> <p style="padding: 5px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B 62 D																	
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="width: 60%; border-bottom: 1px solid black;">Citation of Document,<sup>11</sup> with indication, where appropriate, of the relevant passages<sup>12</sup></th> <th style="width: 30%; border-bottom: 1px solid black;">Relevant to Claim No.<sup>13</sup></th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">SE, B, 463812 (HELGE RADSTRÖM) 17 June 1988, see the whole document</td> <td style="vertical-align: top; padding: 5px;">1-6</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; padding: 5px;">---</td> <td style="vertical-align: top; padding: 5px;">7-11, 13</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">WO, A1, 8900928 (KARLIN, HALDO) 9 February 1989, see page 15, line 17; figures 5-6</td> <td style="vertical-align: top; padding: 5px;">7-11, 13</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">DE, A1, 2935715 (NAAMANKA, ORVO KALEVI) 20 March 1980, see figures 1-3</td> <td style="vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">WO, A1, 8404284 (HÄGLINGE INDUSTRI AB) 8 November 1984, see figure 1</td> <td style="vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td colspan="3" style="text-align: center; padding: 5px;">-----</td> </tr> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	X	SE, B, 463812 (HELGE RADSTRÖM) 17 June 1988, see the whole document	1-6	Y	---	7-11, 13	Y	WO, A1, 8900928 (KARLIN, HALDO) 9 February 1989, see page 15, line 17; figures 5-6	7-11, 13	A	DE, A1, 2935715 (NAAMANKA, ORVO KALEVI) 20 March 1980, see figures 1-3	1	A	WO, A1, 8404284 (HÄGLINGE INDUSTRI AB) 8 November 1984, see figure 1	1	-----		
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>* Special categories of cited documents:<sup>10</sup></b></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																							
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search  <b>10th March 1992</b> </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report  <b>1992 -03- 13</b> </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority  <div style="text-align: center; padding-top: 10px;"><b>SWEDISH PATENT OFFICE</b></div> </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer  <div style="text-align: center; padding-top: 10px;">   <b>Kenneth Gustafsson</b> </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <b>10th March 1992</b>	Date of Mailing of this International Search Report <b>1992 -03- 13</b>	International Searching Authority <div style="text-align: center; padding-top: 10px;"><b>SWEDISH PATENT OFFICE</b></div>	Signature of Authorized Officer <div style="text-align: center; padding-top: 10px;">   <b>Kenneth Gustafsson</b> </div>																	
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00831**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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